Indian Institute of Information Technology, Sri City,
Chittoor Dist., Andhra Pradesh

(An Institute of National Importance under an Act of Parliament)

S20190010007

High Performance Computing

End-Sem Exam-UG3

Date: 18/04/2022 **Duration: 3 hours** **Marks: 60**

Instructions:

1. Closed book test
2. All sub-parts of the question should be written together

Answer all the Questions

1. a. A compiler designer is trying to decide between two code sequences for a particular machine. Based on the hardware implementation, there are three different classes of instructions: Class A, Class B, and Class C, and they require one, two, and three cycles respectively.

   The first code sequence has 8 instructions: 3 of A, 3 of B, and 2 of C.

   The second sequence has 5 instructions: 2 of A, 2 of B, and 1 of C.

   i. Which sequence will be faster? How much?

   ii. What is the CPI for each sequence? [3+2]

   b. A programmer has parallelized 97% of a program, but there is no value increasing the problem size, i.e., the program will always be running with the same problem size regardless of the number of processors or cores used. What is the expected speedup on 20 processors? Explain all the steps involved.

2. a. What are the sources of overhead in parallel programs? [2+3]

   b. Explain in detail about the edge detection in images? How to calculate the parallel time, speedup and efficiency in edge detection?

3. Explain in detail about controlling threads and synchronization objects with an example? [5]

4. a. What is an OpenMP? How do threads interact in OpenMP? [4]

   b. Explain in detail about OpenMP Directives with an example? [8]

   c. Describe the environment variables in an OpenMP? [3]

5. Explain the following:

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a. Different types of Send and Receive operations in MPI [4]

b. Collective communication and computation operation in MPI [8]

c. Cannon's matrix multiplication in MPI [3]

6. a. Explain how the CUDA-C program executes at kernel level with an example? [6]

b. Illustrate any three different applications of CUDA? [4]

c. Write in detail about the summing vectors code with respect to CPU and GPU? Explain the process of execution [5]

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